

New distribution record for the threatened armoured suckermouth catfish *Pareiorhaphis garbei* (Ihering, 1911) (Siluriformes: Loricariidae) in São João river basin, Rio de Janeiro, southeastern Brazil

Gabriela Farias Maia¹, Roney Emanuel Costa de Paiva¹, Aline Barbosa dos Santos¹, Henrique Lazzarotto² and Sergio Maia Queiroz Lima^{1*}

¹ Universidade Federal do Rio Grande do Norte, Departamento de Ecologia, Botânica e Zoologia, Av. Senador Salgado Filho 3000, Lagoa Nova. CEP 56078-970. Natal, RN, Brazil.

² Universidade Federal do Rio de Janeiro, Instituto de Biologia, Programa de Pós-Graduação em Ecologia, Departamento de Ecologia, Laboratório de Ecologia de Peixes. Cidade Universitária, CCS, Bloco A, Cx. Postal 68020. CEP 21941-590. Rio de Janeiro, RJ, Brazil.

* Corresponding author. E-mail: smaialima@gmail.com

ABSTRACT: The present study records the first occurrence of the threatened armoured suckermouth catfish *Pareiorhaphis garbei* (Ihering, 1911) in São João river basin and also its presence in four conservation units in the coastal basins of Serra dos Órgãos mountains, Rio de Janeiro state, Brazil. In São João river basin, *P. garbei* was only captured in a single locality at 111 m a.s.l., consisting in the lower registered altitude for the species, previously found in high altitudes, usually above 800m.

Pareiorhaphis Miranda-Ribeiro, 1918 is an armoured suckermouth catfish genus including 21 nominal species (Pereira and Reis 2002; Pereira 2005; Pereira *et al.* 2007, 2010, 2012; Pereira and Britto 2012) recently placed in the Neoplecostominae subfamily (Pereira 2005) of the Loricariidae, the most specious family within the order Siluriformes with c.a. 870 valid species (Eschmeyer and Fong 2013). Most species of *Pareiorhaphis* present patchy distributions, restricted to southern and southeastern Brazil and southern state of Bahia (Pereira *et al.* 2012). They are mostly found in fast-flowing clear water rivers and streams, grazing on rocks of the streambed, conditions usually associated with mountain water bodies.

Pareiorhaphis garbei (Ihering, 1911) is so far the only species of the genus recorded in Rio de Janeiro state, occurring in the coastal slopes of Serra dos Órgãos mountains. Individuals are more commonly found in the rocky cold clearwater streams of Macaé and Macacu river basins (Lazzarotto *et al.* 2007; Pereira and Brito 2008), usually above 800 m a.s.l. *Pareiorhaphis garbei* is currently present in many endangered species list (MMA 2004; Machado *et al.* 2005), including the Red Book of Brazilian Fauna (Machado *et al.* 2008), classified as endangered due to riparian deforestation, urban expansion, and river pollution (Pereira and Brito 2008), as well as by the introduction of non-native rainbow trout *Oncorhynchus mykiss* (Walbaum, 1792), a potential predator, in upper stretches of Macaé river basin (Lazzarotto *et al.* 2007). Pereira and Brito (2008) stated that as a conservation measure, it would be recommended to sample adjacent coastal drainages to the precise delimitation of the species' geographic distribution. According to Nascimento and Campos (2011), *P. garbei* was not recorded in any federal conservation unit, although it occurs in several streams within the watersheds of at least three conservation areas:

Serra dos Órgãos National Park, Três Picos State Park and the Environmental Protection Area of Sana (Lazzarotto *et al.* 2007).

The specimens collected were identified as *Pareiorhaphis garbei* according to the key of species proposed by Pereira and Reis (2002) and comparisons with diagnostic features of recently described congeners (Pereira 2005; Pereira *et al.* 2007, 2010, 2012; Pereira and Brito 2012), mainly due to the presence of lower lip papillae decreasing in size toward the posterior border, simple unicuspid teeth without lateral cusp and nuptial males with pectoral-fin spines thickened and ornamented with long hyperthrofied odontodes. Its known distribution was assessed by consulting several data in the scientific literature (*e. g.* Bizerril and Primo 2001; Pereira and Reis 2002; Weber 2003; Pereira 2005; Buckup *et al.* 2007; Lazzarotto *et al.* 2007; Menezes *et al.* 2007; Pereira and Brito 2008; Nascimento and Campos 2011; Pereira *et al.* 2012) and major ichthyological collections such as Museu de Ciências and Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul (MCP), the Museu Nacional do Rio de Janeiro (MNRJ) and Museu de Zoologia da Universidade de São Paulo (MZUSP) available for consults through the national system of information on ichthyological collections (SIBIP/NEODAT III, 2013). Sites where specimens were collected were included in a GIS base map containing limits of all Atlantic Forest conservation units (Cunha *et al.* 2011) to assure the presence of the species in protected conservation units.

During field studies conducted between October 2006 and June 2013 in the coastal slopes of Serra do Mar mountains, Rio de Janeiro state, *P. garbei* was recorded in five sites from four distinct watersheds: Santo Aleixo, Guapi/Macacu, São João and Macaé river basins (Figure 1, Table 1). While the Santo Aleixo and Guapi/Macacu

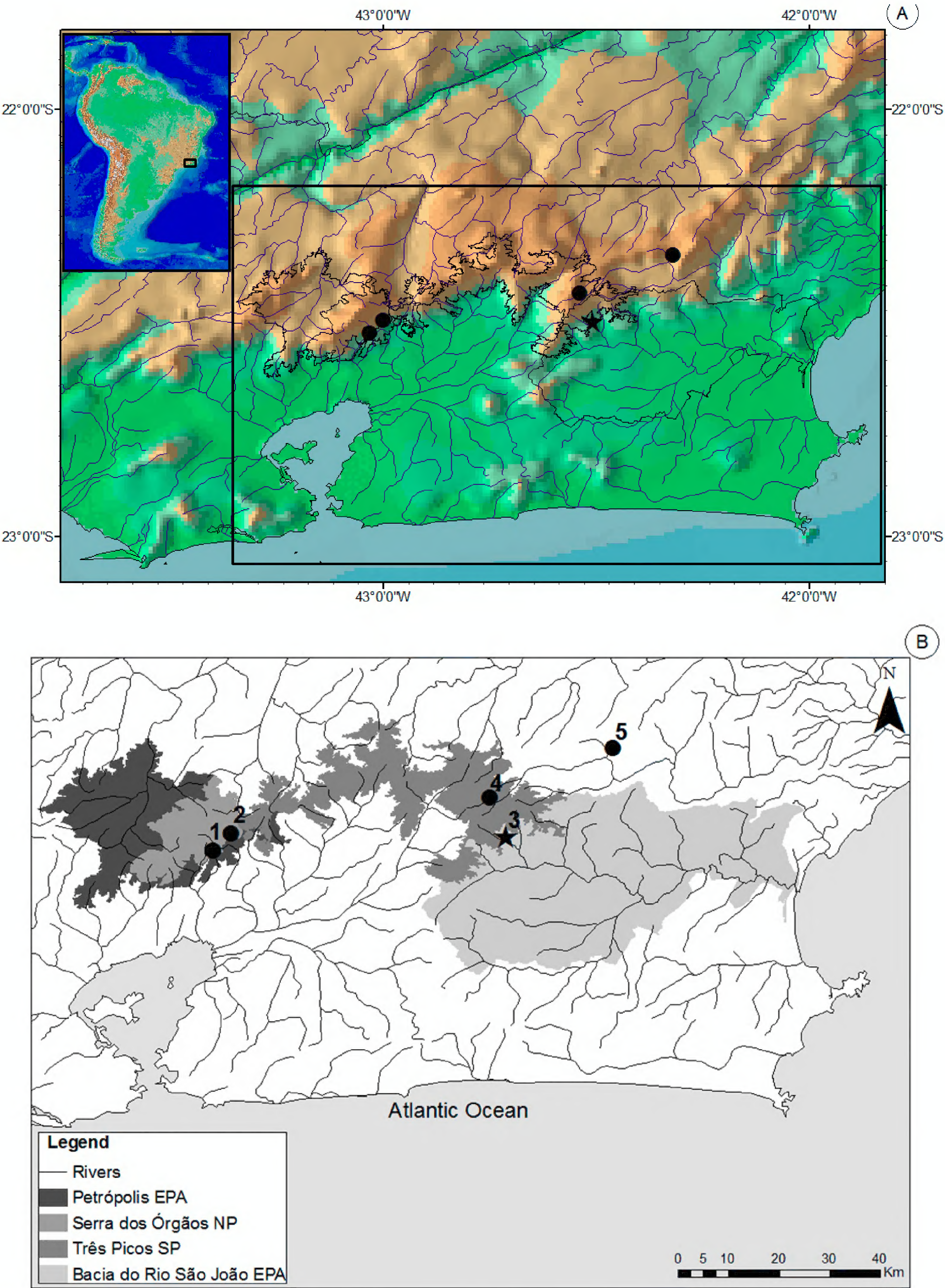


FIGURE 1. *Pareiorhaphis garbei* geographic distribution in previous known basins (circles) and the new record for the São João river basin (star) in Serra dos Órgãos mountains, Rio de Janeiro state, Brazil. A. Relief map showing collection sites on the southern slope of the Serra dos Órgãos mountains (dashed brown) and coastal plains (green); B. Occurrences in conservation units are: Environmental Protection Area of Petrópolis (Petrópolis EPA), Serra dos Órgãos National Park (Serra dos Órgãos NP), Três Picos State Park (Três Picos SP) and Environmental Protection Area of Bacia do Rio São João (Bacia do Rio São João EPA).

rivers drains in the Guanabara Bay, the São João and Macaé rivers flow into the east coast of Rio de Janeiro state (Figure 1A). The record of *P. garbei* individuals in São João river basin (Figure 2) constitute the first record for this watershed, therefore extending its distribution area. All localities were georeferenced using GPS, except for Guapi/Macacu river basin locality, which was provided by MSc. C. Cronemberger from Serra dos Órgãos National Park.

Fish were collected under licenses #28332-1 and #30532-1 issued by SISBIO/ICMBio/MMA and #049/2011 issued by INEA/RJ. The specimens were anesthetized with diluted ethanol, fixed in 10% formalin solution, later transferred to 70% ethanol and were deposited in the ichthyological collection of Universidade Federal do Rio Grande do Norte (UFRN, Table 1). The specimens collected varied from 28.6 to 101.7 mm SL. Tissue samples were taken from individuals of all populations sampled.

Eight species were recorded with *P. garbei*: *Ancistrus multispinis* Regan, 1912 (São João river basin), *Characidium vidali* Travassos, 1967 (São João and Guapi/Macacu river basins), *Neoplecostomus microps* (Steindachner, 1877) (Macaé and Santo Aleixo river basins), *Rhamdioglanis transfasciatus* Miranda Ribeiro, 1908 (Macaé, São João and Santo Aleixo river basins), *Schizolecis guntheri* Miranda Ribeiro, 1918 (Macaé and Santo Aleixo river basins), *Scleromystax barbatus* (Quoy and Gaimard, 1824) (Macaé river basin), *Trichomycterus* sp. (São João river basin)

and *Trichomycterus zonatus* (Eigenmann, 1918) (Macaé, Guapi/Macacu and Santo Aleixo river basins).

The results show the presence of *P. garbei* in drainages of four conservation units in Rio de Janeiro state: three Federal Conservation Units (Serra dos Órgãos National Park, Environmental Protection Area of Bacia do Rio São João and Environmental Protection Area of Petrópolis) and one of state administration (Três Picos State Park) (Figure 1B). Both Serra dos Órgãos National Park (NP) and Três Picos State Park are conservation units of integral protection and can be considered more effective to conservation efforts. On the other hand the Environmental Protection Area (EPA) of Bacia do Rio João, where the occurrence of *P. garbei* is now recorded, despite being a sustainable use conservation unit, presents anthropogenic impacts mainly related to riparian deforestation. The sampling site in the EPA of Bacia do Rio São João is similar to habitat characteristics where *P. garbei* had been previously recorded, with strong currents, crystal clear waters and rocky bottom (Pereira and Brito 2008), but at much lower altitudes, about 110 m a.s.l., than in the other basins.

Although in the previous known localities *P. garbei* was found in high altitudes, usually above 800 m (Lazzarotto et al. 2007; Pereira and Brito 2008), its altitudinal range was between 1090 to 269 m, with lower altitudes in the Guanabara Bay river basins (269 m in Santo Aleixo river and 410 m in Guapi/Macacu river basin, Table 1). In the



FIGURE 2. Live male of *Pareiorhaphis garbei*, UFRN 1025, 82.92 mm SL, captured in São João river basin, Rio de Janeiro state, Brazil.

TABLE 1. Occurrences of *Pareiorhaphis garbei* in coastal basins of Serra dos Órgãos mountains, Rio de Janeiro state, Brazil. Conservation Units are: Environmental Protection Area of Petrópolis (Petrópolis EPA), Serra dos Órgãos National Park (Serra dos Órgãos NP), Três Picos State Park (Três Picos SP) and Environmental Protection Area of Bacia do Rio São João (Bacia do Rio São João EPA). Altitude in meters above sea level (a. s. l.); n, number of specimens.

CONSERVATION UNIT	DRAINAGE	MUNICIPALITY	GEOGRAPHIC COORDINATES	ALTITUDE	CATALOG NUMBER (N)
1. Serra dos Órgãos NP /Petrópolis EPA	Santo Aleixo	Magé	22°31'29.7"S 43°01'54.1"W	269 m	UFRN 103 (21), 111 (3)
2. Serra dos Órgãos NP /Petrópolis EPA	Guapi/Macacu	Guapimirim	22°29'32.1"S 43°00'03.3"W	400 m	UFRN 092 (32)
3. Bacia do São João EPA	São João	Silva Jardim	22°29'54.5"S 42°30'34.6"W	111 m	UFRN 010 (16), 1025 (2)
4. Três Picos SP	Macaé	Nova Friburgo	22°25'50.1"S 42°32'20.2"W	1090 m	UFRN 098 (36), 108 (4)
5. None	Macaé	Nova Friburgo	22°20'31.1"S 42°19'08.6"W	658 m	UFRN 116 (1)

record presented herein, in São João river basin, *P. garbei* was only captured in a single locality at 111 m a.s.l., consisting in the lowest altitude registered for the species (Figure 3, Table 1).

Both coastal and inland streams located in areas adjacent to the presently know distribution of *P. garbei* are in an advanced degradation state, and pressures over the conservation units are increasingly stronger. Due to its limited distribution and anthropogenic alterations over its natural habitat, the conservation status of *P. garbei* still brings concern even with its occurrence confirmed in four conservation units and the distribution expansion disclosed herein. The presence of *P. garbei* restricted to a single tributary in São João river basin, adjacent to headwaters of Macaé river basin, where the species also occurs may be due to a river capture as result of erosive processes in the coastal slope of the Serra do Mar mountains (Ribeiro 2006; Ribeiro et al. 2006; Menezes et al. 2008; Buckup 2011). Ongoing phylogeographic studies with *P. garbei* will shed light in the processes involved in the current geographic distribution and will contribute to conservation measures of this threatened armoured suckermouth catfish.



FIGURE 3. Sampling site of *Pareiorhaphis garbei* in São João river basin, Environmental Protection Area of Bacia do Rio São João, Silva Jardim, Rio de Janeiro state, Brazil.

ACKNOWLEDGMENTS: We are thankful to Henrique Jabor, Jean Miranda, Milena Vieira and Thiago Barros for help during field collections, to Edson Pereira (MCP) for confirming *Pareiorhaphis garbei* identification, and to MSc. Cecilia Cronemberger for information on geographic data regarding Serra dos Órgãos NP. GFM received Scientific Initiation grant by *Pró-Reitoria de Pesquisa* (PROPESQ) and RECP by *Programa de Apoio a Planos de Reestruturação e Expansão das Universidades Federais* (REUNI).

LITERATURE CITED

- Bizerril, C.R.S.F. and P.B.S. Primo. 2001. *Peixes de águas interiores do Estado do Rio de Janeiro*. Rio de Janeiro: FEMAR-SEMADS. 417 p.
- Buckup, P.A., N.A. Menezes and M.S. Ghazzi. 2007. *Catálogo das espécies de peixes de água doce do Brasil*. Rio de Janeiro: Museu Nacional. 195 p.
- Buckup, P.A. 2011. The Eastern Brazilian Shield; p 203-210. In J.S. Albert and R.E. Reis (ed.). *Historical Biogeography of Neotropical Freshwater Fishes*. California: University of California Press.
- Cunha, A.A., F.B. Guedes and H. Gurgel. 2011. *Mapa de Unidades de Conservação e Terras Indígenas na Área de Aplicação da Lei da Mata Atlântica*. Brasília: Ministério do Meio Ambiente.
- Eschmeyer, W.N. and J.D. Fong. 2012. *Species of Fishes by family/subfamily*.

Electronic Database accessible at <http://research.calacademy.org/redirect?url=http://researcharchive.calacademy.org/research/Ichthyology/catalog/SpeciesByFamily.asp>. Captured on 7 September 2013.

- Lazzarotto, H., M.F.G. Brito and E.P. Caramaschi. 2007. Threatened fishes of the world: *Pareiorhaphis garbei* (Ihering, 1911) (Ostariophysii: Loricariidae). *Environmental Biology of Fishes*, 78: 91-92.
- Machado, A.B.M., C.S. Martins and G.M. Drummond. 2005. *Lista da Fauna Brasileira Ameaçada de Extinção: Incluindo as Espécies Quase Ameaçadas e Deficientes em Dados*. Belo Horizonte: Fundação Biodiversitas. 160 p.
- Machado, A.B., G.M. Drummond and A.P. Puglia. 2008. *Livro vermelho da fauna brasileira ameaçada de extinção*. Brasília: Ministério do Meio Ambiente. 1420 p.
- Menezes, N.A., S.H. Weitzman, O.T. Oyakawa, F.C.T. Lima, R.M.C. Castro and M.J. Weitzman. 2007. *Peixes de água doce da Mata Atlântica: lista preliminar das espécies e comentários sobre conservação de peixes de água doce neotropicais*. São Paulo: MZUSP. 407 p.
- Menezes, N.A., A.C. Ribeiro, S.H. Weitzman and R.A. Torres. 2008. Biogeography of Glandulocaudinae (Teleostei: Characiformes: Characidae) revisited: phylogenetic patterns, historical geology and genetic connectivity. *Zootaxa* 1726: 33-48.
- MMA (Ministério do Meio Ambiente). 2004. Lista nacional das espécies de invertebrados aquáticos e peixes ameaçados de extinção com categorias da IUCN. Instrução Normativa no. 5 de 21 de maio de 2004. *Diário Oficial da União* 102: 102-142.
- Nascimento, J.L. and I.B. Campos. 2011. *Atlas da fauna brasileira ameaçada de extinção em Unidades de Conservação Federais*. Brasília: Instituto Chico Mendes de Conservação da Biodiversidade. 276 p.
- Pereira, E.H.L. 2005. Resurrection of *Pareiorhaphis* Miranda Ribeiro, 1918 (Teleostei: Siluriformes: Loricariidae), and description of a new species from the rio Iguaçu basin, Brazil. *Neotropical Ichthyology* 3 (2): 271-276.
- Pereira, E.H.L. and R.E. Reis. 2002. Revision of the loricariid genera *Hemipsilichthys* and *Isbrueckerichthys* (Teleostei: Siluriformes), with descriptions of five new species of *Hemipsilichthys*. *Ichthyological Exploration of Freshwaters* 13(2): 97-146.
- Pereira, E.H.L. and M.F.G. Brito. 2008. *Hemipsilichthys garbei* Ihering, 1911; p. 217-218. In: A.B.M. Machado, G.M. Drummond and A. P. Puglia (ed.). *Livro Vermelho da Fauna Ameaçada de Extinção*. Brasília: Ministério do Meio Ambiente.
- Pereira, E.H.L. and M. Britto. 2012. A new distinctively colored catfish of the genus *Pareiorhaphis* (Siluriformes: Loricariidae) from the Rio Piracicaba, upper rio Doce basin, Brazil. *Copeia* 2012(3): 519-526.
- Pereira, E.H.L., F. Vieira and R.E. Reis. 2007. A new species of sexually dimorphic *Pareiorhaphis* Miranda Ribeiro, 1918 (Siluriformes: Loricariidae) from the upper rio Doce basin, Brazil. *Neotropical Ichthyology* 5(4): 443-448.
- Pereira, E.H.L., F. Vieira and R.E. Reis. 2010. *Pareiorhaphis scutula*, a new species of neoplecostomine catfish (Siluriformes: Loricariidae) from the upper rio Doce basin, Southeastern Brazil. *Neotropical Ichthyology* 8(1): 33-38.
- Pereira, E.H.L., P.F. Lehmann and R.E. Reis. 2012. A new species of the Neoplecostomine catfish *Pareiorhaphis* (Siluriformes: Loricariidae) from the Coastal basins of Espírito Santo, Eastern Brazil. *Neotropical Ichthyology* 10(3): 539-546.
- Ribeiro, A.C. 2006. Tectonic history and the biogeography of the freshwater fishes from the coastal drainages of eastern Brazil: an example of faunal evolution associated with a divergent continental margin. *Neotropical Ichthyology* 4(2): 225-246.
- Ribeiro, A.C., F.C.T. Lima, C. Riccomini and N.A. Menezes. 2006. Fishes of the Atlantic Rainforest of Boracéia: testimonies of the Quaternary fault reactivation within a Neoproterozoic tectonic province in southeastern Brazil. *Ichthyological Exploration of Freshwaters*, 17(2): 157-164.
- SIBIP/NEODAT III. *Sistema Brasileiro de Informações sobre Biodiversidade de Peixes. Sistema Nacional de Informações sobre Coleções Ictiológicas*. Electronic Database accessible at <http://www.mnrj.ufrj.br/pronex/>. Captured on 7 June 2013.
- Weber, C. 2003. Subfamily Hypostominae; p. 352-372. In R.E. Reis, S.O. Kullander and C.J. Ferraris Jr (ed.). *Checklist of the Freshwater Fishes of South and Central America*. Porto Alegre: EDIPUCRS.

RECEIVED: July 2013

ACCEPTED: September 2013

PUBLISHED ONLINE: October 2013

EDITORIAL RESPONSIBILITY: Pedro Hollanda Carvalho